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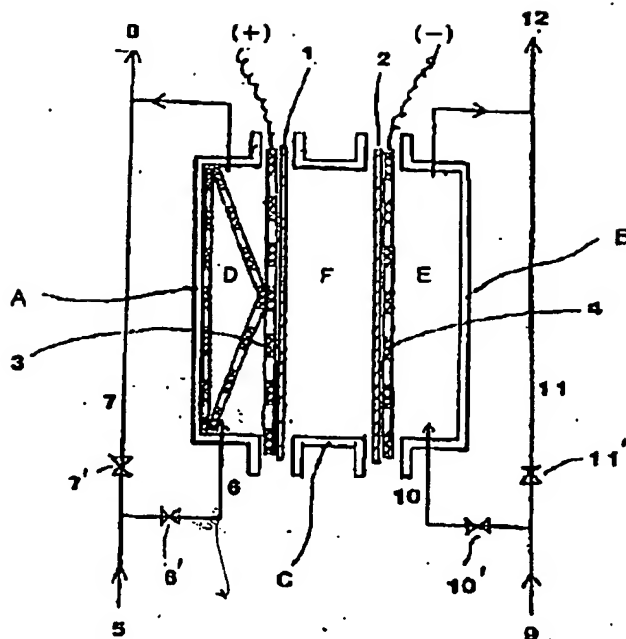
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TITLE : METHOD OF PRODUCING  
ELECTROLYTIC WATER AND  
ELECTROLYTIC WATER



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**ABSTRACT :** PROBLEM TO BE SOLVED: To provide a method of producing acidic electrolytic water having long-lasting bactericidal activity and hardly causing metal corrosion, by which the formation of scales is prevented, and to provide a new acidic electrolytic water.

**SOLUTION:** The electrolytic water is produced by using an electrolytic cell which is constituted of three cells of an anode cell D, a neutral cell F and a cathode cell E. In the electrolytic cell, a diaphragm 1 demarcating the cell D and the cell F is made of an anion exchange membrane and an electrode plate having many holes is installed at each of the cell D and the cell F, and further an anode plate 3 is arranged in such a state that at least two electrode plates are electrically connected to each other and an electrolyte is accommodated in the cell F. At that time, raw water 5 to be supplied to the anode side is divided into water 6 subjected to electrolysis treatment and water 7 (of  $\leq 1/4$  of the raw water) not subjected to electrolysis treatment, and direct current is supplied in amount of  $\geq 1,500$  coulombs per 1 l of the water 6. The amount (L/min) of water 10 supplied to the cell E and subjected to electrolysis treatment is made to be not more than the value obtained by dividing the direct current (ampere second) to be loaded by 1,500 coulombs. The acidic electrolytic water has a pH of 3 to 5, a free chlorine ion concentration of  $\geq 15$  ppm and a chlorine ion concentration of  $\leq 100$  ppm.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] This invention relates to the approach of electrolyzing water and manufacturing electrolysis water. Moreover, the holding time of sterilizing properties is long and is related with a lifting in metallic corrosion at pile acidity electrolysis water.

[0002]

[Description of the Prior Art] The electrolysis water obtained by electrolyzing the water which added the little chlorine-based electrolyte, for example, salt, contains free chlorine, presents a strong high oxidation reduction potential (ORP) with acidity, and has a powerful bactericidal effect to various kinds of bacteria, such as Escherichia coli, or bacteria. Therefore, it is beginning to be widely used for sterilization in the medical field, the agricultural field, the dairy field, etc. The free chlorine concentration which a pH value is 2.7 or less, and an oxidation reduction potential is 1100mV or more, and contains the physical properties of acid common electrolysis water is 10-60 ppm, and chlorine ion concentration is more than 355 ppm (0.01 mols). However, according to the announcement of the latest society etc., the main cause by which acid electrolysis water shows strong sterilizing properties is called what is depended on the contained free chlorine ( $\text{Cl}_2$ ,  $\text{HClO}$ ). There is also an announcement that the high oxidation reduction potential (ORP) has contributed to sterilizing properties on the other hand. Therefore, the requirement of acid electrolysis water with strong sterilizing properties is keeping free chlorine concentration and an oxidation reduction potential higher than fixed.

[0003] The approach like a degree is learned by the approach of manufacturing acid electrolysis water. Namely, the approach of letting flow and electrolyzing the water which added the electrolyte beforehand into the water electrolyzer of two-room structure which divided into the anode plate room and the cathode room by the diaphragm arranged in the middle. Moreover, a batch uses the water electrolyzer of three-room structure which prepared the anode plate room, the middle room, and the cathode room by the diaphragm of two sheets. Letting flow the raw water which contains an electrolyte in a middle room, establishes an anode plate in an anode plate room, establishes cathode in a cathode room, and does not add an electrolyte in an anode plate room and a cathode room the electrolyte which carried out the load of the direct current to coincidence on two poles, and was contained in the middle room -- electrophoresis -- electrolysis processing -- it is the approach of electrolyzing, while supplying service water etc.

[0004] this invention person uses the water electrolyzer of three-room structure. As the water flow approach of raw water the water (it may be called service water following and electrolysis processing --) which carries out electrolysis processing of the raw water supplied to the anode plate and cathode side, respectively It is made to shunt toward the water (for it to be hereafter called non-electrolyzing treated water) which does not carry out electrolysis processing. electrolysis processing -- it lets only service water flow in an anode plate room and a cathode room -- making -- this electrolysis processing -- the electrolysis approach to which the load of the direct current 1500C [ per l. ] or more is carried out to service water was proposed (Japanese Patent Application No. No. 52550 [ 11 to ]). By this approach,

acid electrolysis underwater free chlorine concentration can be raised from before, or electrolysis effectiveness can be raised and the trouble in which a scale adheres to a negative plate can be prevented [ \*\*\*\* / cutting down power consumption ]. moreover, if electrolysis effectiveness improves sharply compared with the former, for example, power consumption compares it, it will have been made to 50-100W of 1/10 to the power consumption per l. in the case of the electrolysis method of two-room structure being 500-1000W. Moreover, as for the volume, about 1l. the capacity for /is acquired with the current burden of 7.5A. However, saving of the further power consumption and improvement in production capacity are desired.

[0005] On the other hand, although the need in each field has been increasing that the acid electrolysis water manufactured by the above-mentioned approach should utilize those outstanding sterilizing properties, the greatest fault of this water is that corrosive [ over metals such as that the holding time of sterilizing properties is short and a medical device, ] is high. The cause that the holding time of the sterilizing properties of this acid conventional electrolysis water is short is for what became the gestalt of the chlorine gas of the free chlorine ( $\text{Cl}_2$ ) to evaporate easily, and it is mentioned that one of the causes which causes metallic corrosion has the high electrolytic concentration (anions, such as salinity and a chlorine ion) contained in acid electrolysis water. Usually, in the acid electrolysis water manufactured by the approach of adding an electrolyte beforehand to the water electrolyzer of the above-mentioned two-room structure, letting flow to it, and electrolyzing into raw water at it, salinity of 500 to 1000 ppm contains. For this reason, the holding time of sterilizing properties is extremely short, and there is a fault which metallic corrosion tends to generate. moreover, the electrolyte contained in the middle room by letting flow the raw water which does not add an electrolyte in an anode plate room and a cathode room using the water electrolyzer of the above-mentioned three room structure, and carrying out the load of the direct current to two poles -- electrophoresis -- electrolysis processing -- even if it is the case of the acid electrolysis water manufactured by the approach of electrolyzing while supplying service water, it usually comes out that the electrolyte (anions, such as a chlorine ion) exceeding 100 ppm contains.

[0006]

[Problem(s) to be Solved by the Invention] This invention was made in view of the above-mentioned situation, and the water electrolyzer of the above-mentioned three-room structure is used for it. The free chlorine concentration most important when improvement in an extensive improvement of electrolysis effectiveness and productivity can be attained and sterilizing properties are secured is kept high (15 ppm or more) enough. And the holding time of sterilizing properties which lessened the electrolyte to contain, especially the amount of chlorine ions as much as possible (100 ppm or less) is long, and it aims at offering the approach of manufacturing without causing the trouble of scale generating [ metallic corrosion ] of pile acidity electrolysis water in a lifting, and acid new electrolysis water.

[0007]

[A means to solve invention] As a result of advancing research in order to make the above-mentioned purpose attain, this invention person devised the class of diaphragm to be used, the installation approach of an electrode, the water flow approach of raw water, and electrolysis conditions using the water electrolyzer of three-room structure, and completed this invention. moreover, it is required to think that the causes of the strong sterilizing properties which acid electrolysis water shows are a low pH value and a high oxidation-reduction-potential value, and to keep a pH value or less at 2.7 conventionally,, although it thought When the greatest factor which shows the powerful sterilizing properties which acid electrolysis water has is free chlorine contained with the gestalt of a hypochlorous acid and raised free chlorine concentration rather than the pH value or the oxidation-reduction-potential value more than constant value, even if some pH values were high, they knew that sterilizing properties could fully be maintained, and completed this invention.

[0008] Namely, this invention consists of three rooms of the anode plate room and middle room which were divided with the diaphragm of two sheets, and a cathode room. (1) The diaphragm which isolates an anode plate room and a middle room is anion exchange membrane, and the diaphragms which isolate (2) middle room and a cathode room are cation exchange membrane or a nonwoven fabric, and textile

fabrics. (3) The negative plate with which many holes are [ an anode plate with which many holes are ] in a cathode room again is installed in an anode plate room, respectively. The anode plate of this anode plate room is arranged after at least two electrode plates have flowed electrically. And it is the approach of manufacturing electrolysis water using the cell which contained the electrolyte containing a chlorine ion in (4) middle room. It is made to shunt toward service water and non-electrolyzing treated water. the raw water supplied to an anode plate side -- electrolysis processing -- this electrolysis processing -- non-electrolyzing treated water is again joined [ service water ] in 1/4 or less electrolysis treated water of raw water which came out of comparatively, and the anode plate room was made to let flow, and was discharged from the anode plate room -- making -- moreover, the above-mentioned anode plate -- electrolysis processing -- it is the electrolysis water manufacture approach characterized by carrying out the load of the direct current 1500C [ per 1l. of service water ] or more.

[0009] Moreover, this invention consists of three rooms of the anode plate room and middle room which were divided with the diaphragm of two sheets, and a cathode room. (1) The diaphragm which isolates an anode plate room and a middle room is anion exchange membrane, and the diaphragms which isolate (2) middle room and a cathode room are cation exchange membrane or a nonwoven fabric, and textile fabrics. (3) The negative plate with which many holes are [ an anode plate with which many holes are ] in a cathode room again is installed in an anode plate room, respectively. And it is the approach of manufacturing electrolysis water using the cell which contained the electrolyte containing a chlorine ion in (4) middle room. It is made to shunt toward service water and non-electrolyzing treated water. (a) -- the raw water supplied to an anode plate side -- electrolysis processing -- The 1/4 or less [ of raw water ] electrolysis treated water which came out of comparatively, and the anode plate room was made to let flow, and was discharged from the anode plate room is made for service water to join non-electrolyzing treated water again. this electrolysis processing -- It is made to shunt toward service water and non-electrolyzing treated water. moreover, the raw water supplied to (b) cathode side -- electrolysis processing -- Make a cathode room let service water flow and the electrolysis treated water discharged from the cathode room is made to join non-electrolyzing treated water again. this electrolysis processing -- And it is the electrolysis water manufacture approach characterized by making the direct current (ampere second) which carries out the load of the amount of water (a part for liter/) of the electrolysis processing supplied to (c) cathode room below into the numeric value which <sup>\*\*</sup>(ed) by 1500C.

[0010] Moreover, this invention is electrolysis water obtained by electrolyzing water, and a pH value is acid electrolysis water with which 3-5, and free chlorine concentration are characterized by 15 ppm or more and chlorine ion concentration being 100 ppm or less.

[0011]

[Embodiment of the Invention] In manufacture of the acid electrolysis water of this invention, use anion exchange membrane as a diaphragm which isolates (i) anode plate room and a middle room. (ii) Arrange, after at least two electrode plates have flowed through the anode plate of an anode plate room electrically. It is made to shunt toward service water and non-electrolyzing treated water. (iii) the raw water supplied to an anode plate room -- electrolysis processing -- Service water is made into the method which makes the 1/4 or less [ of raw water ] electrolysis treated water which came out of comparatively, and the anode plate room was made to let flow, and was discharged from the anode plate room join non-electrolyzing treated water again. this electrolysis processing -- electrolysis processing -- by combining the Sanjo affair of <sup>\*\*</sup> to which the load of the direct current 1500C [ per 1l. of service water ] or more is carried out The acid electrolysis water whose free chlorine concentration can perform large electrolysis improvement in efficiency and improvement in productivity, and is 15 ppm or more and whose chlorine ion concentration is 100 ppm or less can be manufactured.

[0012] First, the acid electrolysis water manufacture approach of this invention is explained using a drawing. Drawing 1 and drawing 2 are the sectional views of the cell for water electrolysis used by this invention. Drawing 1 shunts raw water toward the water (electrolysis processing service water) which carries out electrolysis processing at an anode plate and cathode side, respectively, and the water (non-electrolyzing treated water) which does not carry out electrolysis processing. the shunted electrolysis processing -- it is the example of the structure which joins each non-electrolyzing treated water after

letting service water flow in an anode plate room and a cathode room, and drawing 2 is an example which an anode plate room and a cathode room are alike, respectively, prepares a cooling room, and lets non-electrolyzing treated water flow to this cooling room in the above-mentioned water flow method. [0013] Drawing 1 is the sectional view of an example of the water electrolyzer used by this invention approach. This water electrolyzer is equipped with the cell which prepared the anode plate room, the middle room, and the cathode room by dividing with the diaphragm of two sheets. (A), (B), and (C) are the walls of a cell, respectively. This cell is divided into the anode plate room (D), the middle room (F), and the cathode room (E) by the diaphragm (1) and the diaphragm (2). Anion exchange membrane is used for a diaphragm (1). Moreover, cation exchange membrane or a nonwoven fabric, and textile fabrics are used for a diaphragm (2). (3) And (4) is an electrode plate, an electrode plate (3) is an anode plate and an electrode plate (4) is cathode. Many holes have opened to each electrode plate. Two or more electrode plates (3) are in the condition which contacted mutually, namely, the electrode plate (3) of an anode plate room is arranged after each electrode plates have flowed electrically. arrangement of these two or more electrode plates -- arbitrary -- electrolysis processing -- it may be arranged in parallel in the water flow direction of service water, and that may not be right. Moreover, spacing of an electrode plate (3) and a diaphragm (1) and spacing of an electrode plate (4) and a diaphragm (2) may be stuck even if separated. Drawing 1 shows the case where it has stuck.

[0014] the anode plate room (D) of the cell of the above-mentioned water electrolyzer, and a cathode room (E) -- respectively -- alike -- electrolysis processing -- the raw water supplied to the anode plate [ of the water electrolyzer ], and cathode side in this invention although service water was made to let flow and electrolysis processing was carried out -- electrolysis processing -- it shunts toward service water and non-electrolyzing treated water, and electrolysis actuation is carried out. namely, the raw water (5) supplied to the anode plate side -- electrolysis processing -- it is shunted toward service water (6) and non-electrolyzing treated water (7). electrolysis processing -- service water (6) passes through an anode plate room (D), after electrolysis processing is carried out, it joins non-electrolyzing treated water (7), is diluted, and turns into acid predetermined electrolysis water (8). the raw water (9) supplied to the cathode side on the other hand -- electrolysis processing -- it is shunted toward service water (10) and non-electrolyzing treated water (11). electrolysis processing -- service water (10) passes through a cathode room (E), after electrolysis processing is carried out, joins non-electrolyzing treated water (11) and turns into predetermined alkalinity electrolysis water (12). They are (6'), (7'), and (10') (11') a bulb for adjusting amount of water, respectively. An orifice and a capillary may be used instead of a bulb and amount of water may be adjusted. A middle room (F) is filled up with the high-concentration electrolyte water solution containing a chlorine ion. Usually, 10% or more of water solution of potassium chloride or a sodium chloride may be used, and you may feed from the water-solution tank formed independently using a pump etc.

[0015] the electrolysis processing which lets water flow in the anode plate room for electrolysis (D) -- 1/4 or less [ of the raw water (5) which supplies the amount of water of service water (6) to an anode plate side ] -- becoming -- making -- a direct current (ampere second) -- electrolysis processing -- a load is carried out so that it may become the value of 1500C or more per 1l. of service water. moreover, the electrolysis processing which lets water flow in a cathode room (E) on the occasion of electrolysis -- as for the amount of water (a part for liter/) of service water (10), it is desirable to carry out to below the numeric value that \*(ed) and computed the direct current (ampere second) which carried out the load by 1500C. In an anode plate side, anions, such as a chlorine ion contained in the electrolyte water solution with which it was filled up in the middle room (F), move by electrophoresis into an anode plate room (D) based on the transference number of each ion, and then an anion and water are electrolyzed in an electrode surface. On the other hand, in a cathode side, cations, such as sodium ion contained in the electrolyte water solution in a middle room (F), move into a cathode room (F) based on the transference number of each ion, and then a cation and water are electrolyzed in an electrode surface.

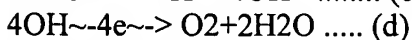
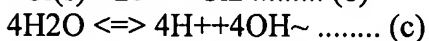
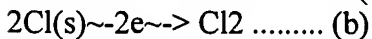
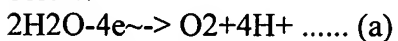
[0016] The water electrolyzed and generated at an anode plate room and a cathode room is the acid electrolysis water and the alkaline electrolysis water which were condensed, respectively, and it is mixed with non-electrolyzing treated water (7) and (11), respectively, and it turns into acid electrolysis water of

predetermined concentration, and alkaline electrolysis water. It can prevent ion's excessive at diffusing power etc. penetrating a diaphragm, and moving to an anode plate room in addition to the chlorine ion which can prevent cations, such as sodium which exists in a middle room (F), moving to an anode plate room, and moves by electrophoresis, by using anion exchange membrane in this invention as a diaphragm (1) into which an anode plate room (D) and a middle room (F) are divided. Therefore, it is effective in the ability to press down to the minimum the amount of mixing of the electrolyte contained in acid electrolysis water.

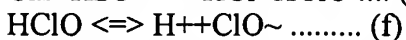
[0017] In this invention, the load of the direct current 1500C [l. ] or more is carried out to the electrolysis duty of water by the anode plate side. The reason for carrying out the load of the direct current 1500C [l. ] or more As a result of investigating a current burden required to prevent the infusion solution phenomenon of the water which is one of the causes to which electrolysis effectiveness is reduced, the value was 1500C/l. or more, It is because adhesion of the scale in cathode will not be seen and will come to be, if the load of the direct current 1500C [l. ] or more is carried out to a showing [ the phenomenon in which the generation effectiveness of free chlorine increased by 1. in 1500C /or more ], and cathode side to the electrolysis duty of water. And the pH value of the strong acid nature electrolysis water generated in the anode plate interior of a room at the time of a 1500C [l. ] or more current load becomes 1.9 or less, and 12.1 or more are the pH value of the strong-base nature electrolysis water of the cathode interior of a room. In this invention, the strong acid nature electrolysis water and strong-base nature electrolysis water which were generated in this anode plate interior of a room join non-electrolyzing treated water, respectively, are diluted, and can be used as the acid water and the alkaline water of a predetermined pH value.

[0018] and the raw water supplied to an anode plate room like the above in this invention -- electrolysis processing -- it shunts toward service water and non-electrolyzing treated water -- making -- this electrolysis processing -- service water, although 1/4 or less electrolysis treated water of raw water which came out of comparatively, and the anode plate room was made to let flow, and was discharged from the anode plate room is made to join non-electrolyzing treated water again this time -- electrolysis processing -- it is for 1/4 or less it being comparatively alike and carrying out [ of raw water ] carrying out the load of the direct current 1500C [l. ] or more for service water to the electrolysis duty of water. That is, although the experience value of a direct current required to manufacture the acid electrolysis water for 1l./is 6.25A or more and this corresponds [ 1. ] in 375C /or more, if electrolysis treated water is made or less into 1/4, without changing a direct-current load, the amount of coulombs per 1l. of this electrolysis treated water will become more than  $375 \times 4 = 1500$  C.

[0019] If the load of the direct current is carried out to an anode plate and cathode, anions, such as a chlorine ion of the middle interior of a room, will move to an anode plate room by electrophoresis in proportion to a current, and cations, such as sodium, will move to cathode. In the anode plate interior of a room, water and a chlorine ion react on an anode plate front face based on the reaction formula shown below.

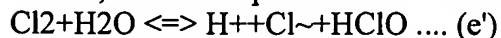


(b) Based on the (e) type, the chlorine gas generated at the reaction of a formula reacts with water, and generates a hydrochloric acid and a hypochlorous acid. Moreover, some hypochlorous acids are dissociated to a hydrogen ion and a hypochlorite by the static reaction based on the (f) type.



[0020] As shown in the (e) type and the (f) type, there are three gestalten of  $\text{Cl}_2$ ,  $\text{HClO}$ , and  $\text{ClO}^-$  in free chlorine. A difference is in sterilizing properties at these, and  $\text{ClO}^-$  is called about 1/80 sterilizing properties compared with other two. Drawing 3 is drawing showing the abundance ratio of the free chlorine generally used often of Kumpora and Linz. This drawing shows the abundance ratio of the free chlorine of three gestalten,  $\text{Cl}_2$  and  $\text{HClO}$  to pH value change, and  $\text{ClO}^-$ . However, although this

drawing is using only the pH value as the factor, if the (e) type is analyzed and seen from a viewpoint of chemical equilibrium, Cl<sup>-</sup>ion will also participate in chemical equilibrium in addition to a pH value. That is, if it decomposes further and the (e) type is expressed, it will become a degree type (e') type.



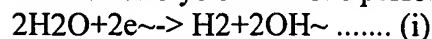
[0021] (e') the case of the chemical equilibrium based on a formula -- a pH value -- being low (; with high hydrogen ion concentration -- there being much H<sup>+</sup>) -- even if chemical equilibrium shifts to the left, and Cl<sub>2</sub> increases and Cl<sup>-</sup>ion increases, chemical equilibrium shifts to the left and Cl<sub>2</sub> increases it. It is drawing 4 which calculated and showed this relation to the detail. The rate of ClO<sup>-</sup>ion with weak sterilizing properties increases that a pH value is five or more, and drawing 3 explained previously shows that it is not desirable. Drawing 4 shows that the ratio of the chlorine gas (Cl<sub>2</sub>) which constitutes free chlorine becomes high, and that the ratio of the chlorine gas (Cl<sub>2</sub>) which constitutes the free chlorine which the amount of a chlorine ion (Cl<sup>-</sup>ion) to contain increases, and [which is increasing in drawing 4 with 35.5 ppm, 100 ppm, 180 ppm, 355 ppm, and 607 ppm (=NaCl:1000ppm)] becomes high, if a pH value falls. A deer is carried out, and since chlorine gas (Cl<sub>2</sub>) tends to evaporate compared with a hypochlorous acid (HClO), its maintenance period of sterilizing properties is short. Therefore, since generation of chlorine gas (Cl<sub>2</sub>) is not desirable, generation of chlorine gas (Cl<sub>2</sub>) is pressed down.

[0022] The acid electrolysis water by the conventional method which drawing 5 added about 1000 ppm (Cl<sup>-</sup>ion = 607 ppm) to raw water, set salt as it at pH2.2, and manufactured it (A), The acid electrolysis water which the chlorine ion (Cl<sup>-</sup>ion) content manufactured by 180 ppm, and pH manufactured by this invention approach of 2.6 (B), It is the graph which put into the PET bottle which opened each acid electrolysis water wide, and measured aging of the free chlorine concentration of each acid electrolysis water about the acid electrolysis water (C) of this invention which the chlorine ion (Cl<sup>-</sup>ion) content manufactured by 60 ppm, and pH manufactured by this invention approach of 3.2. According to drawing 5, the maintenance period of the free chlorine concentration related to sterilizing properties is the sequence of (A) > (B) > (C) most as the above-mentioned explanation. Drawing 6 plots the relation between the pH value of acid electrolysis water, and an oxidation reduction potential (ORP). It is shown that it is necessary to carry out a pH value 4.5 or less for keeping an oxidation-reduction-potential value at 1000mV or more.

[0023] Moreover, since it has arranged so that the anode plate interior of a room may be contacted mutually and it may flow through two or more electrode plates electrically as a positive electrode in it, the reaction based on the above-mentioned (b) formula can be made to perform to the chlorine ion which moved to the anode plate interior of a room efficiently in this invention. namely, electrolysis processing little from the raw water supplied to the water electrolyzer in this invention -- service water is shunted -- making -- this little electrolysis processing, although electrolysis processing of the service water is carried out under a 1500C [l/l.] or more current load In such a case, the acid electrolysis underwater chlorine ion concentration which many chlorine ions which pass many holes opened in the electrode existed, without having only arranged the electrode of one sheet in the anode plate room, and electrolyzing into it by request in an electrode surface, therefore was manufactured becomes high. however -- if it arranges so that it may flow through two or more electrode plates electrically mutually at an anode plate room -- a chlorine ion -- efficient -- supplementing -- therefore, the reaction of the above-mentioned (b) formula -- efficient -- \*\*\*\*\* -- things are made. Therefore, the manufactured acid electrolysis underwater free chlorine concentration can be raised to 15 ppm or more, and, on the other hand, chlorine ion concentration can be reduced to 100 ppm or less. Moreover, by arranging so that it may flow through two or more electrode plates electrically mutually at an anode plate room, electrolytic voltage can be lowered and electrolysis effectiveness can be raised.

[0024] Moreover, adhesion of the scale in cathode is no longer seen by dividing into non-electrolyzing treated water and electrolysis treated water the raw water supplied to a cathode side, and making it become below the numeric value that \*(ed) and computed the direct current (ampere second) which carried out the load of the amount of water (a part for liter/) of the electrolysis treated water which it lets pass in a cathode room by 1500C. That is, according to this invention approach, a scale can cancel the adhering trouble to cathode. This operation effectiveness is demonstrated even if it is arranged

regardless of arrangement of the electrode of an anode plate room, after two or more electrode plates have flowed electrically, even if one electrode plate has been arranged at the anode plate room. The reason for the ability to decrease the attachment phenomenon of a scale to this cathode is explained. The main electrolysis reactions performed in cathode are as follows.



Like the above-mentioned reaction formula, metal ions, such as sodium, are returned with generating of a hydroxide ion and hydrogen gas, it once becomes a metal, and water and the phenomenon of reacting happen further in cathode. If ion, such as calcium, magnesium, and a silica, exists underwater at this time, in order that those ion is also returned at the same reaction, it may be metalized or components, such as calcium and magnesium, may generate a hydroxide, these often carry out deposition to an electrode surface as a scale.

[0025] Thus, the phenomenon in which a scale adheres to cathode from the former in the case of the electrolysis of water is considered as an unescapable thing, the hardness component contained in raw water, using a water softener etc. as adhesion preventive measures is removed, or the becoming measures from which the scale adhering to an electrode is washed from an acid and which it becomes [ measures ], reverse the polarity of an electrode and make a scale exfoliate are taken. the electrolysis which lets water flow in the cathode room in the case of generating alkaline electrolysis water by electrolysis by the conventional approach -- although the amount of currents which carries out a load to service water is about (720C/(l.)) 12A per l./m about, often depositing on the surface of a negative plate in the case of this condition, and becoming a scale is observed. As a result of studying the conditions which do not deposit a scale in cathode, when it carried out visual observation of the electrode surface at the time of electrolysis using the cell which manufactured the side attachment wall of a cathode room with the ingredient of transparence, and the load of the 1500C /or more of the currents 1800C [l. ] or more was carried out preferably 1. and pH of a cathode room was made into 12.1 or more strong-base nature to the amount of water flow, it checked that a scale did not deposit in an electrode surface. It is surmised that this reason is because many scale components are dissolved or it is hard to deposit a crystal under strong-base conditions. Furthermore, compared with the diaphragm by the side of an anode plate, the direction of the ion permeability of the diaphragm by the side of cathode chooses a large thing, and maintaining the pH value of the water solution of the middle interior of a room at acidity also has the effectiveness which prevents generating of a scale.

[0026] PH values are 3-5, free chlorine concentration is 15 ppm or more, and the chlorine ion concentration of invention of claim 3 of this invention is acid electrolysis water 100 ppm or less. With a pH of 1.9 or less strong acidity water can be made to generate by the manufacture approach of this claim 1 invention, in the anode plate interior of a room, as described above. and raw water and electrolysis processing -- service water -- comparatively -- that is, it can be made the acid water of various pH values by adjusting the rate when making electrolysis treated water join non-electrolyzing treated water, and diluting it. the pH value of the viewpoint referred to as being easy to keep the oxidation reduction potential said to be related to sterilizing properties from a viewpoint of strong HClO generation of the sterilizing properties mentioned above in this claim 3 invention at 1000mV or more to acid electrolysis water -- 3-5 -- it is preferably made 3.1-4.5.

[0027] the raw water supplied to the anode plate side of the above of this invention -- electrolysis processing -- even if it raises the above-mentioned dilution rate and makes a pH value high with 3-5 by adopting the method which is made to shunt toward service water and non-electrolyzing treated water, and carries out electrolysis processing, and the method which arranges two or more anode plates to the anode plate interior of a room, can maintain the free-chlorine concentration of the acid electrolysis water to 15 ppm or more, and chlorine-ion concentration can maintain to 100 ppm or less. The pH value of acid conventional electrolysis water is 2.7 or less. Moreover, although the free chlorine concentration of acid conventional electrolysis water was 10-60 ppm, chlorine ion concentration was more than 335 ppm (0.01 mols), the metal was rusted or there was a trouble that the maintenance period of sterilizing

properties was short Even if a pH value is as high as 3-5, since there is much free chlorine, the acid electrolysis water of this invention is excellent in disinfectant. Since chlorine ion concentration is as small as 100 ppm or less, there is little generation of the chlorine gas which HClO exists in stability and is easy to evaporate, and it is rare to be able to keep the maintenance period of sterilizing properties long and to make a metal produce corrosion and \*\*\*\*.

[0028] Drawing 2 is the sectional view of other examples of the water electrolyzer used by this invention approach, and is the example which prepared the passage of non-electrolyzing treated water inside the side attachment wall (A, B) of the cell of drawing 1. That is, in an anode plate side, it is the example which formed the septum (13) inside the side attachment wall (A), and established the passage (G) which lets non-electrolyzing treated water (7) flow in the clearance between a side attachment wall (A) and a septum (13). the electrolysis processing which lets water flow in an anode plate room -- service water (6) is introduced into an anode plate room (D), and, on the other hand, is structure which non-electrolyzing treated water (7) is introduced into passage (G), and the electrolysis treated water electrolyzed at the anode plate room and the non-electrolyzing treated water (7) which passed through passage are again mixed near an outlet, and is discharged for piping (8). In addition, you may mix within piping in the place which came out of the cell, and mixing with electrolysis treated water and non-electrolyzing treated water may prepare a hole near the up outlet of a septum (13), may lead electrolysis treated water to passage (G) through this hole, may be mixed with non-electrolyzing treated water here, and may be made to discharge from piping (8). moreover, electrolysis -- the introductory approach of service water (6) may introduce directly from the inlet port established in the lower part of those with three kind, and an anode plate room, may introduce raw water into passage (G) first, may introduce it into an anode plate room from the hole which prepared in the lower part of a septum (13), and may make it permute by the generation water after electrolysis, and gas, and it may introduce from the hole for outlets which prepared in the upper part of a septum (13).

[0029] Moreover, in a cathode side, a septum (14) is formed inside a side attachment wall (B), and the passage (H) which lets non-electrolyzing treated water (11) flow is established in the clearance between a side attachment wall (B) and a septum (14). the electrolysis processing which lets water flow in a cathode room -- service water (10) is introduced into a cathode room (E), and, on the other hand, non-electrolyzing treated water (11) is introduced into passage (H). And the electrolysis treated water electrolyzed at the cathode room (E) and the non-electrolyzing treated water which passed through passage (H) are structures which are again mixed near an outlet and are discharged for piping (12). In addition, you may mix within piping in the place which came out of the cell, and mixing with electrolysis treated water and non-electrolyzing treated water may prepare a hole near the up outlet of a septum (14), may lead electrolysis treated water to passage (H) through this hole, may be mixed with non-electrolyzing treated water here, and may be made to discharge from piping (12). moreover, electrolysis -- the introductory approach of service water (10) may introduce directly from the inlet port established in the lower part of those with three kind, and a cathode room, after it introduces raw water into passage (H) first, it may introduce into a cathode room from the hole prepared in the lower part of a septum (14), and may make it permute by the generation water after electrolysis, and gas, and it may introduce from the hole for outlets which prepared in the upper part of a septum (14). Moreover, you may combine and use so that an anode plate side may be used as the equipment of drawing 2 and a cathode side may be used as the equipment of drawing 1.

[0030] The approach of carrying out water electrolysis using the water electrolyzer of drawing 2 can be performed according to the approach explained by drawing 1. Moreover, passage (G) and passage (H) are prepared in the water electrolyzer of drawing 2. The water which flows passage (G) and passage (H) has the operation and effectiveness which cool the heat produced in the anode plate interior of a room and the room in cathode in the case of electrolysis.

[0031] The electrode plate used with the water electrolysis processor of this invention is explained. As for the ingredient of an electrode plate, copper, lead, nickel, chromium, titanium, a tantalum, gold, platinum, an iron oxide, stainless steel, a carbon fiber, the plate of graphite, etc. are used. What plated the metal of a platinum group to titanium especially as an ingredient of an anode plate, or was carried

out by the ability being burned is used preferably. Moreover, as an ingredient of a negative plate, high chromium stainless steel (SUS316L) and nickel may be used. Moreover, many holes of 1.0-3.0mm of apertures are prepared in the electrode plate. Even when an electrode plate is reticulated, it is good. Moreover, as a diaphragm used with the water electrolysis processor of this invention, anion exchange membrane is used for the diaphragm into which an anode plate room and a middle room are divided. Moreover, although it is desirable to use a cation exchange membrane for the diaphragm into which a middle room and a cathode room are divided, textile fabrics and the nonwoven fabric which consist of polyvinyl fluoride system fiber, asbestos, glass wool, polyvinyl chloride fiber, polyvinylidene chloride fiber, polyester fiber, an aroma group polyamide fiber, polyester fiber, nylon fiber, and a polyethylene fiber can also be used. An electrode plate and a diaphragm are stuck [ be / necessary / to make it make / it ].

[0032]

[Example] The example of this invention using the water electrolyzer shown in example 1 drawing 2 is explained. The electrode which calcinated platinum / oxidization iridium to the having [ an effective area ]-50cm-many holes (1.0-3.0mm of apertures) of 2 titanium plate was used for the electrode plate for anode plates (3). the electrode plate of an anode plate -- two sheets and three sheets -- or five sheets were used and it measured about each case. When an electrode was used two or more sheets, it considered as the condition of a part of each electrode plate having touched, and having flowed electrically. The effective area used the electrode which carried out platinum plating at the electrode plate for cathode (4) for the having-hole (1.0-3.0mm of apertures) of a large number which are 2 (square centimeter) 50cm titanium plate. The anion-exchange-resin film was used for the diaphragm (1) of the batch of an anode plate room and a middle room, the cation-exchange-resin film was used for the diaphragm (2) of the batch of a cathode room and a middle room, and the middle room (F) was filled up with the sodium chloride water solution of about 30% of concentration as an electrolyte.

[0033] the raw water which unified into 7.5A the direct current which carries out a load to an electrode plate, and was supplied to the anode plate side -- electrolysis processing -- service water and non-electrolyzing treated water -- shunting -- electrolysis processing -- the amount of water of service water was fixed to a part for 100 cc/, the amount of water of non-electrolyzing treated water was adjusted, and it controlled so that the pH value of the acid electrolysis water which mixes and generates both became the range of 2.6-2.7. moreover, the raw water supplied to the cathode side -- electrolysis processing -- service water and processing in which it does not electrolyze -- service water -- shunting -- each amount of water -- electrolysis processing -- a part for 100 cc/of service water, and processing in which it does not electrolyze -- it considered as a part for 900 cc/of service water. Moreover, the case where a nonwoven fabric (No.1) was used for coincidence at the diaphragm of the batch of an anode plate room and a middle room when there is an electrode plate of an anode plate as an example of a comparison (1 No. 2) was shown. Table 1 makes a table measured value of the manufacture conditions (electrode number of sheets, the class of diaphragm, current) of acid electrolysis water, power consumption and the amount of generation of acid electrolysis water, pH of the acid electrolysis water obtained by the list, an oxidation reduction potential (ORP), a free chlorine content, and chlorine ion concentration.

[0034]

[Table 1]

No	電極 (枚)	隔 膜 (種類)	電流 (A)	消費電 力(W)	生成量 (cc/分)	p H	O R P (m V)	遊離塩素 (p p m)	塩素イオン (p p m)
1	1	不織布	9.0	8 0	1000	2.64	1130	2 5	2 0 0
2	1	陰イオン交換 樹 脂 膜	7.5	6 0	1000	2.60	1140	2 5	1 7 0
3	2	陰イオン交換 樹 脂 膜	7.5	4 0	1700	2.65	1165	2 8	1 0 0
4	3	陰イオン交換 樹 脂 膜	7.5	4 0	1700	2.67	1164	3 0	1 0 0
5	5	陰イオン交換 樹 脂 膜	7.5	5 0	1600	2.67	1160	3 5	1 0 0

[0035] If the anion-exchange-resin film (No.2) is used for the diaphragm of the batch of an anode plate room and a middle room compared with the case where a nonwoven fabric (No.1) is used so that clearly from the above result, consumed electric power will be improved and the concentration of the chlorine ion contained in acid electrolysis underwater will decrease. moreover, the electrode number of sheets used for an anode plate is increased -- making (No.3-5) -- an improvement and production capacity of power consumption increase. However, although the increment in some of free chlorine concentration is seen in the comparison of two sheets (No.3), three sheets (No.4), and five sheets (No.5), others are almost the same. In the case of five sheets, the increment in power consumption is seen a little rather. As for chlorine ion concentration, in any case, it is decreasing compared with the example of one sheet. Moreover, adhesion of a scale in cathode was not seen.

[0036] Example 2 pH value is made or more into 3.1, free chlorine is kept at 15 ppm or more, and the manufacture conditions of acid electrolysis water which show the new physical properties which held down chlorine ion concentration to 100 ppm or less, and an example of the data are shown in Table 2.

[0037]

[Table 2]

No	電極 (枚)	隔 膜 (種類)	電流 (A)	消費電 力(W)	生成量 (cc/分)	p H	O R P (m V)	遊離塩素 (p p m)	塩素イオン (p p m)
1	5	陰イオン交換 樹 脂 膜	4.5	2 0	1600	3.17	1110	2 5	6 0

[0038] As for the acid electrolysis water of this invention shown in this table 2, a pH value is [ 3.17 and the free chlorine of 25 ppm and chlorine ion concentration ] 60 ppm. As shown in that of drawing 5 , and the acid electrolysis water (C of drawing 5 ) which made the pH value 3.1 or more, kept free chlorine at 15 ppm or more, and held down chlorine ion concentration to 100 ppm or less 2.7 or less pH value for which the maintenance period of free chlorine concentration effective in sterilizing properties is manufactured with the electrolytic device of the conventional two-room structure, and is generally used, Compared with the oxidation reduction potential of about 1100mV, 10-40 ppm of free chlorine, and acid electrolysis water (A of drawing 5 ) with a chlorine ion concentration of 300-700 ppm, it is a long period of time far.

[0039] It compared by performing a metallic corrosion trial using the acid electrolysis water manufactured by the manufacture approach of example 3 this invention, and the acid electrolysis water manufactured by the manufacturing installation of the conventional marketing. As a metal for corrosion tests, the spoon and copper plate made from SUS304 stainless steel were used. The corrosion test approach put sample water into each cop, dipped the spoon and the copper plate for five days into it,

respectively, and observed deterioration of a spoon and a copper plate in the water list. The result is shown in Table 3.

[0040]

[Table 3]

	本発明方法の電解水			市販製造装置の電解水
	1	2	3	
pH	2.13	2.64	3.17	2.14
ORP (mV)	1200	1167	1110	1165
遊離塩素 (ppm)	90	30	25	35
蒸発残留物 (ppm)	30	20	20	1039
(SUS304 スプーン)				
酸性電解水	変化なし	変化なし	変化なし	黄変
金属表面状態	変化なし	変化なし	変化なし	鼠色に変色
(銅板)				
酸性電解水	変化なし	変化なし	変化なし	青変
金属表面状態	淡紫色に変色	淡紫色に変色	淡紫色に変色	濃紫色に変色

[0041]

[Effect of the Invention] According to this invention approach, the free chlorine concentration most important when securing sterilizing properties is kept high (15 ppm or more) enough, and the maintenance period of sterilizing properties which lessened the electrolyte moreover contained, especially the amount of chlorine ions as much as possible (100 ppm or less) is long, and can manufacture metallic corrosion to a lifting at the basis of improvement in an extensive improvement of electrolysis effectiveness and productivity by pile acidity electrolysis water. Moreover, although the acid electrolysis water of this invention has a pH value as high as 3-5, it excels in disinfectant. And since there are few chlorine ion contents, the maintenance period of sterilizing properties is long, and it is a pile to a lifting about metallic corrosion. Therefore, it is suitable for sterilization processing of a medical device, in addition can apply also to sterilization processing in the field for agriculture etc.

[0042] Moreover, the fault of the conventional water electrolysis of being easy to generate the trouble in which a scale adheres to cathode by electrolysis can be improved, and the acid electrolysis water of predetermined pH 2.0-5.0 and the alkaline electrolysis water of pH 10.5-12.0 can be manufactured efficiently. Moreover, since adhesion of a scale can be prevented, there is an advantage from which actuation of washing from reversal of the periodical pole of an electrode currently performed conventionally and an acid becomes unnecessary, and the softener of the raw water which carries out electrolysis processing also becomes unnecessary.

[Translation done.]

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CLAIMS

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[Claim(s)]

[Claim 1] It consists of three rooms of the anode plate room and middle room which were divided with the diaphragm of two sheets, and a cathode room. (1) The diaphragm which isolates an anode plate room and a middle room is anion exchange membrane, and the diaphragms which isolate (2) middle room and a cathode room are cation exchange membrane or a nonwoven fabric, and textile fabrics. (3) The negative plate with which many holes are [ an anode plate with which many holes are ] in a cathode room again is installed in an anode plate room, respectively. The anode plate of this anode plate room is arranged after at least two electrode plates have flowed electrically. And it is the approach of manufacturing electrolysis water using the cell which contained the electrolyte containing a chlorine ion in (4) middle room. It is made to shunt toward service water and non-electrolyzing treated water. the raw water supplied to an anode plate side -- electrolysis processing -- this electrolysis processing -- non-electrolyzing treated water is again joined [ service water ] in 1/4 or less electrolysis treated water of raw water which came out of comparatively, and the anode plate room was made to let flow, and was discharged from the anode plate room -- making -- moreover, the above-mentioned anode plate -- electrolysis processing -- the electrolysis water manufacture approach characterized by carrying out the load of the direct current 1500C [ per 1l. of service water ] or more.

[Claim 2] It consists of three rooms of the anode plate room and middle room which were divided with the diaphragm of two sheets, and a cathode room. (1) The diaphragm which isolates an anode plate room and a middle room is anion exchange membrane, and the diaphragms which isolate (2) middle room and a cathode room are cation exchange membrane or a nonwoven fabric, and textile fabrics. (3) The negative plate with which many holes are [ an anode plate with which many holes are ] in a cathode room again is installed in an anode plate room, respectively. And it is the approach of manufacturing electrolysis water using the cell which contained the electrolyte containing a chlorine ion in (4) middle room. It is made to shunt toward service water and non-electrolyzing treated water. (a) -- the raw water supplied to an anode plate side -- electrolysis processing -- The 1/4 or less [ of raw water ] electrolysis treated water which came out of comparatively, and the anode plate room was made to let flow, and was discharged from the anode plate room is made for service water to join non-electrolyzing treated water again. this electrolysis processing -- It is made to shunt toward service water and non-electrolyzing treated water. moreover, the raw water supplied to (b) cathode side -- electrolysis processing -- Make a cathode room let service water flow and the electrolysis treated water discharged from the cathode room is made to join non-electrolyzing treated water again. this electrolysis processing -- And the electrolysis water manufacture approach characterized by making the direct current (ampere second) which carries out the load of the amount of water (a part for liter/) of the electrolysis processing supplied to (c) cathode room below into the numeric value which \*(ed) by 1500C.

[Claim 3] Acid electrolysis water with which it is electrolysis water obtained by electrolyzing water, and a pH value is characterized by 3-5, and free chlorine concentration being [ 15 ppm or more and chlorine ion concentration ] 100 ppm or less.

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[Translation done.]

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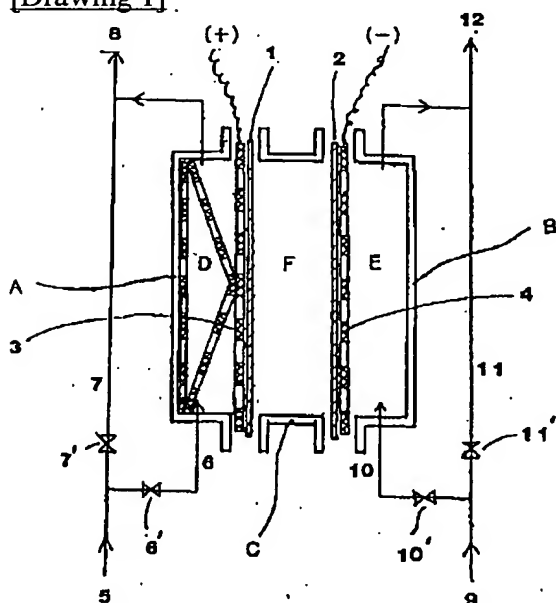
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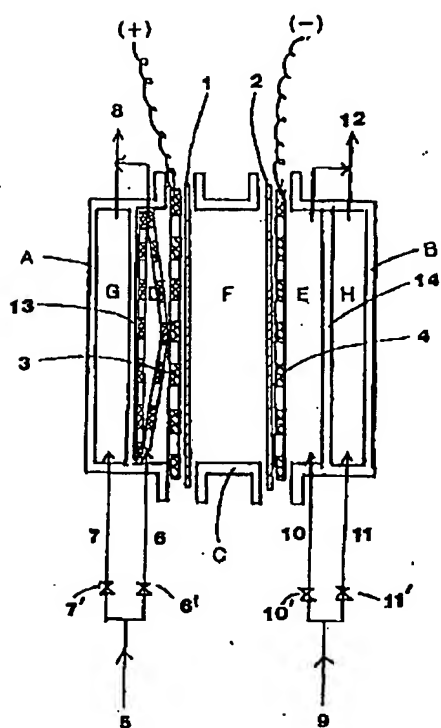
DRAWINGS

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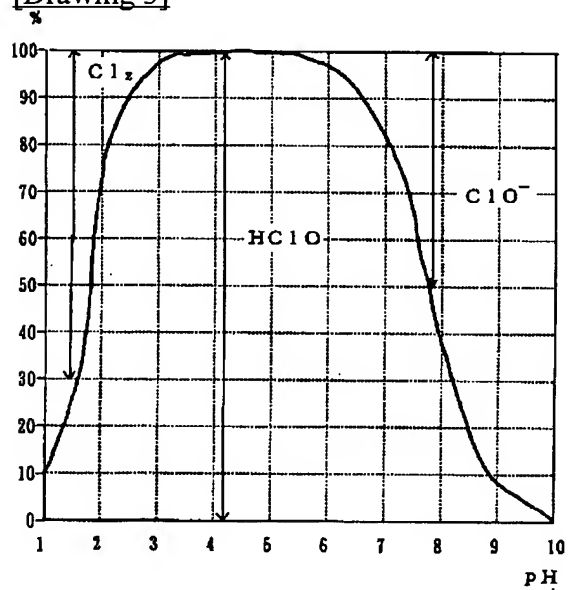
[Drawing 1]



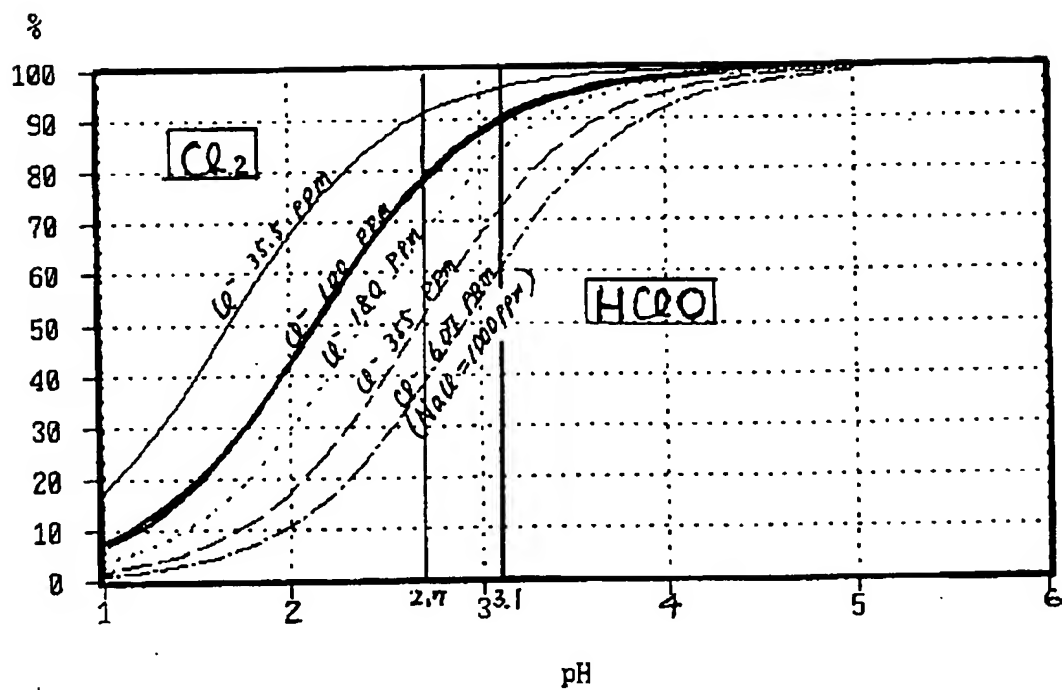
[Drawing 2]



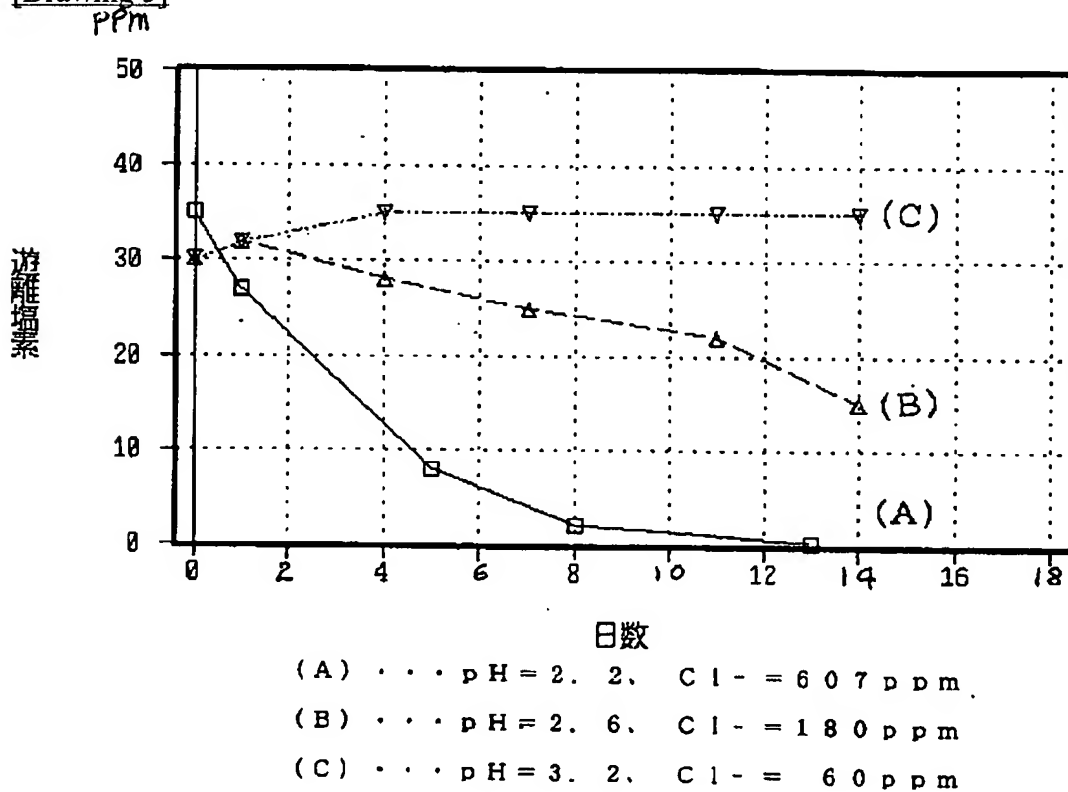
[Drawing 3]



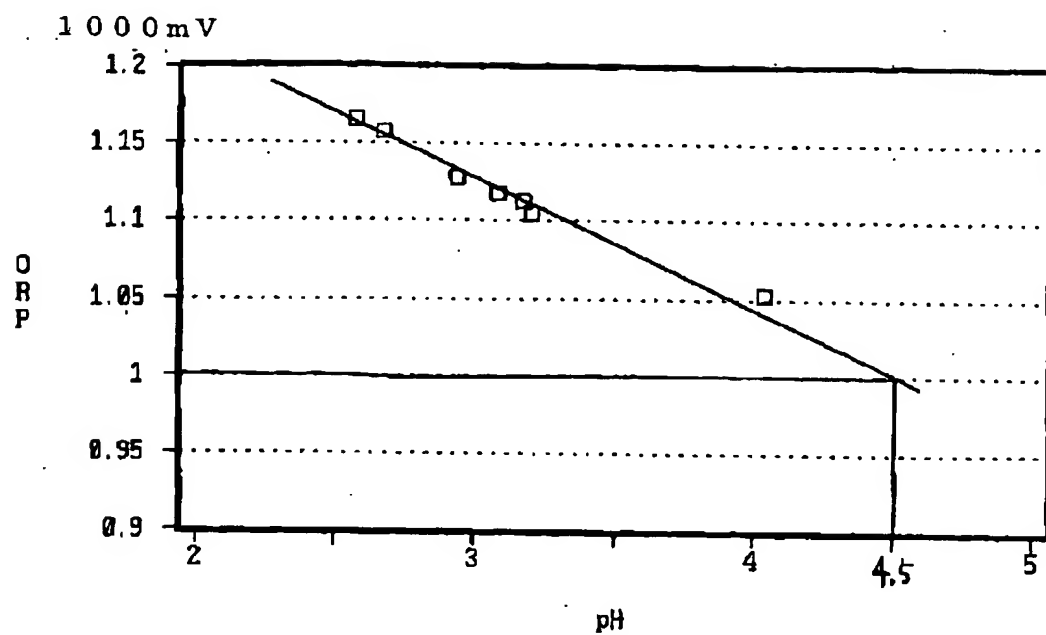
[Drawing 4]



[Drawing 5]



[Drawing 6]



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[Translation done.]